Before The
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Improving 9-1-1 Reliability	)	PS Docket No. 13-75
	)	

COMMENTS OF ASSURE911.NET, LLC

ASSURE911.NET, LLC respectfully submits these comments, pursuant to the Federal Communications Commission's ("Commission") Notice of Proposed Rulemaking (FCC 13-33)("Notice")[1].

In its Notice, the Commission sought comments on approaches to ensure the reliability and resiliency of the communications infrastructure of the nation's 9-1-1 system. The Notice focused on the severe windstorms that caused significant 9-1-1 service outages in June 2012, and referred to the recommendations that were presented in Public Safety and Homeland Security Bureau's (PSHSB or Bureau) January 10, 2013, report titled Impact of the June 2012 Derecho on Communications Networks and Services: Report and Recommendations (*Derecho Report*).[2] Our comments will follow in four parts.

We would first like to comment on questions raised in the NPRM on the subjects of Notification of the PSAP during an Outage, Diversity Reporting, and Reliability Policy.

We then will provide comments as a follow-up to topics discussed in our ex-parte visit to the Commission on April 10, 2013[3], including processes and practices that can be considered for improving reliability of 9-1-1 service, how violations of diversity may be captured as the networks evolve, and maintaining situational awareness during events.

Conclusions to be reached from the above comments will then be listed.

Finally, we provide narrative on the challenges that will confront 9-1-1 System Service providers as the transition to Next Generation 9-1-1 unfolds on a national basis.

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[1] NOTICE OF PROPOSED RULEMAKING, PS Docket 13-75, PS Docket 11-60, Adopted: March 20, 2013, Released: March 20, 2013

[2] FCC PUB. SAFETY & HOMELAND SEC. BUREAU, IMPACT OF THE JUNE 2012 DERECHO ON COMMUNICATIONS NETWORKS AND SERVICES: REPORT AND RECOMMENDATIONS (PSHSB, rel. Jan. 10, 2013), *available at* http://www.fcc.gov/document/derecho-report-and-recommendations (*Derecho Report).*

[3] Notice of Ex-Parte Meeting, Assure911.net, LLC, PS Docket 13-75, April 10, 2013

Part 1 – Comments on questions raised in the NPRM

Notification of PSAP during an Outage

The Commission stated that even with current outage-reporting requirements, many PSAPs reported that they did not receive timely or adequate notice of outages that occurred during the windstorms.[4] It is our view that providing PSAPs timely and adequate notice during any outage is best achieved by automating the delivery of useful information. We believe it should be the responsibility of the designated 9-1-1 System Service Providers (911 SSPs) to provide the information, based on reports from their own systems, or reports from systems of any access, signaling, or transport providers from whom they contract for services. In order for this automated alert to be effective, it is important that access, signaling, and transport establish an interface for the 911 SSP to collect data on the status of the services for which they have contracted. This data in turn can be used to create a useful message to the PSAP. We do acknowledge that the industry may have a reluctance to share sensitive outage information with potential competitors, however in this environment the recipient of the data in question is actually a customer. A customer as it happens, who has a responsibility to keep all aspects of 9-1-1 service operating. Given the critical nature of sharing the knowledge that citizens may not be able to reach 9-1-1 we don't expect any reluctance. In fact, in meetings at which this very topic was discussed, several providers have acknowledged the value of exchanging such data.
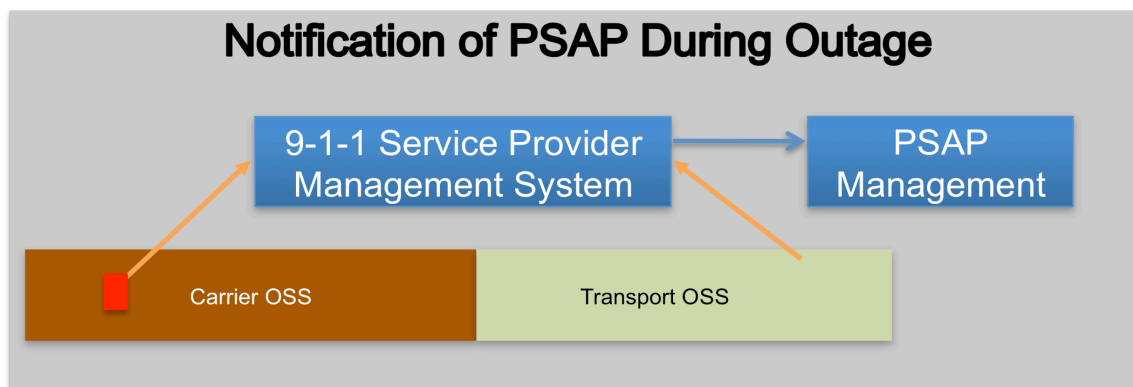
The Commission could establish a rule that supports the automatic notification of PSAP during an outage in which useful, actionable information would be provided. Actionable data and the events which should trigger transmission of the data are shown in the table below. The triggers for sending the data are those events which interfere with calls to be delivered to the PSAP from any of the points where calls or data may originate.

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[4] *See Notice* paragraph 18, page 10

Trouble Type	Relevant Data: Estimated Time of Restoral, and the following:
Isolations	End office, carrier, NPA-NXX-line range effected, number of subscribers
Call failures	Calling Party Number or From URI, or Geo-Location of originator
Selective Router Failure	End offices, carriers, NPA-NXX-line range effected, number of subscribers
NG911 Core Functional Element Failure	End offices, carriers, NPA-NXX-line range effected, number of subscribers
Degraded Service due to overload	End offices, carriers, NPA-NXX-line range effected, number of subscribers
Other Failures in: Transport elements, Facilities, Power, Signaling, Timing, Other components supporting 9-1-1 services	End offices, carriers, NPA-NXX-line range effected, number of subscribers

Table 1 – Relevant Data to be provided to PSAP during an outage

Cost Factors

The cost to a carrier for providing this data is expected to be minimal. Most carriers already collect data representing the above triggers when they occur, with systems that allow electronic forwarding of such collected data. For carriers that may not be using their systems in this manner, or lack the expertise to implement this capability, products and services to aid them are abundant in the industry.

Diversity Reporting

The Commission stated that the 2009 rule implemented after Hurricane Katrina, that asked local exchange, wireless, and VoIP providers to report on resiliency and reliability of their 911 networks or systems proved of limited use in ensuring the current level of reliability in 9-1-1 services. The Commission asked for help crafting a reporting requirement to reliability. [5] We recommend a simple categorization of the physical path to each of the PSAPs to which calls are routed from every separate group of subscribers in each point where calls originate, such as local end office, mobile switching offices, VoIP POIs. A group of subscribers is meant to be those whose calls would be routed from a call origination point to the same PSAP. Since an end office may route calls to multiple PSAPs, the important endpoint from a reliability standpoint is the subscriber base served by the end office for a given PSAP. The categories are described below:

No Diversity	At least one single point of failure exists that could isolate subscribers from all serving PSAPs
Alternate PSAP Diversity	Path to the Primary PSAP has no common points with the path to an Alternate PSAP
Primary PSAP Diversity	There are at least two paths from subscribers to their Primary PSAP

Table 2 – Categories for reporting diversity

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[5] *See id.* paragraph 27, pages 13-14

Note, that if a path traverses a facility that has implicit diversity, such as one with ring-type architecture, that circuit may only be considered as diverse if multiple logical channels were actually verified to be configured for the 9-1-1 service on the facility. Likewise, if two paths traverse the networks of separate transport carriers, the paths can be considered diverse if it can be verified that the two carriers do not share any common facilities.

When assessing the diversity of their 9-1-1 systems, in addition to equipment and facilities, each provider should consider:
- Power
- Grounding
- Timing
- Synchronization
- Signaling

In most cases the path from end subscribers traverses facilities of several carriers; the party that would be required to furnish the report must be discussed. We believe it should be the responsibility of the designated 911 SSP to collect the information from all service providers with whom they contract for services. The parties who transport 9-1-1 traffic under a contract with the designated 911 SSP should have the responsibility to provide the designated 911 SSP with sufficient detail about their underlying access and transport networks to categorize the diversity of their services.

Cost Factors

The cost incurred by providers to produce the information required in a Diversity Report should be similar to the cost of complying with the 2009 Katrina rule.

Reliability Policy

We don't believe it would be necessary to require providers to increase physical diversity as a means to improve reliability. If a Diversity Reporting requirement is implemented, such as the one above we believe it would be in the service providers' business interest to do so voluntarily, to the extent it is cost effective and makes business sense to do so. With the move to Next Generation 9-1-1, PSAPs will have 911 SSP options in a competitive environment. More importantly however, we believe it is possible to improve reliability in areas where physical diversity is a challenge, by making the commitment to pay close attention to all other aspects of 9-1-1 service, including identifying equipment, record-keeping, monitoring and responding to outages, and notifying PSAPs and regulatory agencies when there is a service disruption.

By having solicited information on best practices for the purpose of establishing reliability requirements[6], we expect comments and suggestions from the industry to fall

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[6] *See Notice* paragraph 30, page 15

into several categories. These categories form the framework of a policy on reliability that the Commission may consider.

We recommend the adoption of a Reliability Policy, a ladder of concepts, based on best practices, each level of which closes the gaps on the ones below. The cost of implementing a policy decreases as one moves higher on the ladder.

Notification Policy
Operations Policy
Database Policy
Tagging Policy
Diversity Policy

Table 3 – Reliability Policy Ladder

Diversity Policy – Ensure at least two physically separate paths from every call origination point to the primary PSAP. Where such diversity is not possible due to expense or other reasons, ensure the path from every call origination point to its alternate PSAP is physically separate from the path to its primary PSAP.

Tagging Policy – Ensure that all facilities and equipment which comprise 9-1-1 Services are marked with highly visible tags, to prevent manually induced failures, and foster rapid identification during repairs.

Database Policy – Ensure that records of all facilities and equipment that comprise 9-1-1 Services are stored in a company database, with attributes to foster rapid retrieval. Those familiar with the Telecommunications Service Priority, (TSP), program will have a reference. TSP is an attribute added to circuit inventory database records to indicate the circuits support a critical service, such as the Federal Aviation Authority (FAA) circuits. Other information that should be easily available:

- Identifier and location of the entity
- Trace of the path of circuits and links
- Location and size of the population served by each entity
- Cross-reference to identifiers in data collected from the 9-1-1 system

Operations Policy – Ensure that 9-1-1 facilities and equipment are operated in a manner that fosters increased reliability:

- Troubles are instantly presented to technicians through use of automated surveillance and analysis tools
- Technicians are trained to resolve or escalate
- Isolations are acted upon immediately
- Simplex outages are acted upon promptly
- Continuous Testing (see table below)

System	Test Type	Overview	Impact
E911	Intrusive	Provider calls 9-1-1 from each NPA-NXX declaring that it's a test call	Consumes vast personnel resources, interrupts PSAP operations
E911	Non-intrusive	Test equipment using Foreign Exchange, (FX), lines places test call from each NPA-NXX, routes to special position in PSAP based on caller id, equipment at position ack's the call.	No personnel or PSAP resources affected. Occasional brief busy of single PSAP voice channel. Non-trivial cost to deploy across all NPA-NXX's
NG911	Non-Intrusive	Software in each SIPd process places sos-test call periodically, or at registration from a SIPc, Call Taker software ack's the sos-test	Low cost, non-intrusive on PSAP operations, however, bandwith consumed with additional traffic. Requires Regulatory influence on SIPd and participation by SIPd and Call Taker software developers.

Table 4 – Continuous Testing Architectures

Notification Policy – Ensure that PSAP and appropriate regulatory agencies receive timely notice.
- Provide actionable information
- Using automated alerting tools
- Relevant data based on event type (see table in comments on PSAP Notification)
- Format and timing based on requirements of agency
- Route generated reports to responsible authorized party in company
- Automated interface to regulatory systems

Cost Factors

The cost of implementing this ladder of policies depends on the current state of 9-1-1 operations at each service provider. Most E9-1-1 providers will fall somewhere in between the extremes of having complete, exemplary policies and having none at all. For the E9-1-1 providers that already have processes and procedures in place, and the task is one of reporting on what is already being done. For E9-1-1 providers that do not follow any specific 9-1-1 service policies, where the facilities, processes, and procedures are designed for providing general communications services, it may be a significant cost to plan and implement 9-1-1 specific reliability policies. However it will be a one time cost, and certainly worth it if there is a serious desire to improve 9-1-1 reliability.

Where there is a roll-out of Next Generation 9-1-1 underway, it is likely that reliability policies are being planned. If not, there is time for the Commission to indicate regulatory support for reliability policies to be in place in all new NG9-1-1 deployments.

Part 2 – Comments on topics discussed during Ex-Parte Meeting

Processes and Practices for improving Reliability of 9-1-1 Service

Processes, Practices, and Policies are required to migrate to a more reliable service for 9-1-1. Adoption of practices within each entity are essential. It is essential to establish expectations and measurements in contract language, supported with Service Level Agreements (SLAs), managed in near real time using 24 by 7 by 365 Escalation Contacts and Communications.

Planning and Engineering

The Design, or Planning and Engineering steps in the 9-1-1 process is essential to building reliable networks. This is where the Local Exchange Routing Guide (LERG) and network routing rules comes into play. As the network transitions, where is the repository for the information needed to build these reliable networks? If you read the LERG Info document, there are placeholders for expansion. Today, VoIP Carriers for example, do not have their information in the LERG. There is a place to show if a carrier has SS7 or ISDN-PRI but none for SIP. The LERG is expensive to purchase and maintain, especially for Competitive 911 SSPs and for PSAPs. The LERG has no PSAP information section today per LERG Info. Having used it to build the CSI 9-1-1 network diagrams for call flow and diversity assurance in CSI, it is clear, the LERG an excellent resource. The information not currently available could be expanded. Potentially through NENA membership, PSAPs and 911 SSPs of all sizes could access and update an expanded LERG. Through NENA Membership dues, is there a discount and/or means to share costs of such documentation? The goal: use what is available and expand upon it.

Why is that important?

Today's large networks operate with the use of CLLI, Common Language Location Identification, another product. Working with CSI, we applied for CLLIs for the CSI Data Centers and the FE equipment (equivalents to the Selective Routers) where carriers will terminate facilities trunking and signaling for the NG9-1-1 project.

Reading CLLI, you can see if you have all of your *"eggs in a single non diverse basket". "Common language is the basis for engineers to build their networks and have records, to share between networks for provisioning and maintenance."*

Carriers operate by using sound engineering practices and routing rules. The goal to achieve diversity does not happen after someone realizes they need to be diverse. The day a network is built physically, under every logical network there is real bandwidth whether it be copper, fiber or spectrum that has to be planned, allocation for capacity and throughput. 9-1-1 is a customer of the larger networks, a service. And as such, the Public Safety customer needs diversity redundancy, resilience and security.

That said, the means to maintain the Design in the wake of network churn of any magnitude is the challenge. Systems are the solution to ongoing maintenance. The calls and the information associated with the calls, the messages from the network about how it is built need to come from the network itself. The systems here are the systems engineers use to maintain their networks with diversity.

We at Assure911.net, LLC, created a set of engineering and routing rules for our clients to be used in the implementation of the Counties of Southern Illinois (CSI) Project. The requirement is to ensure each Access Provider (Carrier) knows which Data Center to route to first and alternatively. This implies a diverse network is available, built to standards, and there is bandwidth connectivity to enable the diversity. There is no reason to reinvent the process, but unlike SS7 protocol which automatically balanced signaling loads over links, SIP does not automatically balance calls between separate trunk groups to separate data centers. Once the call is in the ESInet, the SIP protocol will create failover to the alternate routes available for call completion. Load Balance is essential to having a truly operational set of diverse options. In the existing 9-1-1 world, there is diversity often built into the network. But it has to be manually activated and if activated to unused data centers or transport or switches, the possibility of something not being ready to accept the live traffic exists. If the diversity is in use as a matter of engineering, a broken component will be failing over anytime a simplex problem occurs and with maintenance alerts, repair and restoration can take place while customers experience no break in service quality. NENA standards address reliability and diversity. Implementation Policies will make it work.

Inventory Management

Inventory Management can be as simple as an Excel Spreadsheet with Diagrams. It is essential to the process of building and maintaining reliable resilient networks. Diagrams help visualize the network, and then identify the source of the problems, and share concerns in real time from a management and communications perspective. Dynamic Inventory Management is ideal. Sharing detailed Diagrams and related information is sensitive. Non Disclosure Agreements (NDAs) are required to protect the information and keep it secure from hackers, terrorists, and competitors.

Capturing Violations of Diversity as Networks Evolve

The challenge of managing the 9-1-1 network while the total communications network is in transition from circuit switched to IP networks brings an added layer of concern for Reliability. The existing ever evolving 9-1-1 network is the last bastion of the pre-divested telecommunications network architecture leftover from 1984. NENA i3 standards provide a baseline for the 9-1-1 transition which is revolutionary in scope not incremental. That said, there are a lot of simultaneous moving parts and there is no single *"orchestra leader"* for the layers of change we are experiencing worldwide. The Commission can serve in that guiding role assuming the players *"know their instruments and agree to the music,"* the standards.

Maintaining Situational Awareness during Major Events

Maintenance of Situational Awareness during a disaster, event or outage is critical. The same tools that help from the ground up to find resolve and return situations to normalcy can bring data to a higher level to those with a "need to know" and help to bring a greater level of assistance from outside the immediate area.

The entities that need information include but are not limited to:

First Responders

People closest to the customers so they do not rush into burning buildings about to collapse and so they know if there is a shooter or robber or bomb.

Examples: Sandy Hook, Aurora Theater, Boston Marathon.

Public Safety Answering Point (PSAP)

Managers and personnel so they know how to direct personnel, prioritize dispatch, and open up more communications channels including extra staffing and extra PSAPs, virtual PSAPs. This includes the ability with Next Generation 9-1-1 capabilities to redirect calls outside the affected area for added support. It includes the ability to expand the PSAP positions and yet reserve capacity for other people who have needs not related to the storm during the event, such as heart attack, car wrecks, and the like.

The storms that disrupt 9-1-1 service can disrupt the nodes (Switches, Facilities, Power Plants, Buildings, Fiber, Microwave, and more) that serve 9-1-1 and the facilities that support transmission of 9-1-1. Today's pre NG9-1-1 network has more bottlenecks and limited points of diversity than future networks can have if built to standards.

Examples: Hurricane Sandy, Katrina, and Southern Illinois Derecho which exhaust the PSAP resources or take out the capabilities to communicate or serve the area. http://www.youtube.com/watch?v=EGJmOeDEBtw

State Commissions

States have varying requirements for reporting of events, such as elapsed time or size of the impacted population. This is done in part to bring in added resources if it is possible and to apprise the policy makers and press and others of the situation, where warranted.

Example: Floods along the Mississippi and Ohio Rivers threaten the levy in Cairo where mass evacuation orders might be required. Extra assistance may be needed to fill sandbags, to facilitate alternate temporary transport alternate, such as Cellular

on Wheels (COWs), or added Power Plant Generators, fuel for generators, and assistance to bring in replacement Central Office equipment should the one on the other side of the levy became flooded. This FEMA and State assistance is practiced through NS/EP and table top exercises. Each area of the country has its risks, such as those areas prone to earthquakes. The need is to have realistic and locally relevant tests to ensure public safety can communicate with each other and be aware of what is needed. Local people have personal and professional obligations when the event affects their areas.

Note: Where "call boxes" are manned by police, the police doing that are not on the street helping people. Only a few carriers are required to man call boxes in some states. Next Generation Technology with diverse means to communicate means there is less value in old technology and more value in getting every device routed to through a diverse path to the duplicated diverse network to emergency responders.

The goal of the Situational Awareness tools is to help the First Responder see and isolate the trouble before it affects service. The managers of the communications infrastructure can handle resources and expand the network to route around troubles, as well as inform regulators, and bring in added resources as required.

Security is important during many incidents. The tools need to be as secure as the network to prevent mass unwarranted disclosure.

FCC

By the time an event has reached national standards and requirements for reporting, a large number of customers will have been unable to reach emergency service for a long period of time.   In the initial report, the reason for the outage is not as critical as the fact there is an event in progress and enough information about what is happening needs to be transmitted to the FCC Situational Awareness area to allow for national threat assessment and assistance.

Note: If hundreds of PSAPs start sending massive amounts of reports during an event, this may not be efficient unless there is an automated process to handle the data. The people filing the reports need authorization on their end before they submit the reports. Also keep in mind, that while important, the reporting process can drain resources and add time to problem resolution.

The Commission has its own list of constituents, Congress and the President through the chain of command.

What do people want to know?

1.   What is happening - is it a focused problem or an area wide problem

2. Where is it affecting people and how many people at an estimated level
3. Are there sufficient resources available to manage the situation or is added assistance required and what type.
4. Who is in control of the situation and how can they be reached?
5. When status changes, they want updates.
6. When the event ends the COMMISSION and everyone needs to know it ends.
7. Final disposition can be later but the event and risks must be understood in the early part of the analysis.

Bottom Line: What is the Situation and how can it be Analyzed or understood and Responded to as the events unfold from onset to conclusion.

With as few resources as possible diverted from managing the actual events, the data can flow from the source to the parties with unique needs and then brought to the attention of the State and/or Federal Resources.

A simple display can be made available in a **Situational Awareness Room** with versions on Hand Held Devices (smart phones and secure encrypted devices) in case the room is not manned and the State and Federal Level of personnel with a "need to know" can be kept on board.

None of this is a new concept. Because of the effects of "Moore's Law", it is increasingly possible to do this with cheaper and more sophisticated technology end to end in a diverse fashion.

The COMMISSION could have a display starting with a national state by state map. In higher risk areas, the map could be expanded so different people could focus on segments of the country. Simple Alerts:

Green	No Exceptions at the current time
Yellow	Exception occurring but not at the State/or FCC Level
Red	State or FCC Level Alert reached (elapsed time, estimated population impact)

Response

For Yellow alerts, a click or touch screen, and they see a situation building. What, when started and who is in charge.

For Red alerts, the event is FCC Reportable, and reports come to the **FCC Situational Analysis** personnel as the network changes. Continuous updates to status indicators will be displayed on smart phones of the personnel designated to have a "need to know" by the COMMISSION Staff. The changing status will be shown on a status monitor in the situational awareness room.

PSAP notification needs to occur at the first level of alert, including data from inside the 9-1-1 network, and from outside by interfaces with carriers. If the Commission "needs to know" an event is taking place, then a Map with Commission-appropriate PSAP alerts can be accessible to staff. Thousands of PSAPs can be responding every day.   PSAPs can have their own situational awareness at their level if they deploy the systems and interface with their 911 SSPs and Carriers.   The 911 SSPs and Carriers would have to be required to communicate to the PSAPs. The Commission can help with that level of requirement, yet may not want to or be allowed to get involved in the everyday management of Public Safety at the lowest level.

At the Federal Level, it will be most important for the Commission to define what is needed to be visible at a level that is appropriate to their attention.   These requirements need to be based on solid measures and expectations that are reasonable.

The Reporting System can report each event that occurs in the networks where the system is deployed. Service providers that need this capability can issue RFPs for network monitoring alerts and notification as needed. The system can be deployed for a relatively small cost. It uses data extracted from the network and provides correlation of the data so the right levels of alerting are directed to the right parties.

It is not anticipated new databases are required. There are and will be database systems with adequate information to derive the alert data needed without intrusion.

This is a low cost solution and has high value. The challenge is to get it deployed everywhere. It is going to be required whether an area is E9-1-1 or NG9-1-1. That can be determined if it is important to the COMMISSION to distinguish between the two architectures. Requirements drive solutions.

Pictures are worth a thousand words...Simple, professional schematics to show national status.

Part 3- Conclusions

The Commission could establish rules supporting PSAP notification:
     a) Requiring 911 SSPs to provide automated alerts to PSAPs during an outage

The Commission could establish rules supporting Diversity Reporting:
     a) In three categories, No Diversity, Alternate Diversity, Primary Diversity
     b) Requiring 911 SSPs to report on diversity of their systems, from the end subscriber to serving PSAPs.
     c) Requiring access, signaling, and transport providers to provide 911 SSPs detail on diversity of the services provided.

The Commission could establish a Reliability Policy consisting of requirements based on best practices in the areas of:

a) Diversity   d) Operations
b) Tagging   e) Notification
c) Database

End-to-End Network Monitoring, Alerting and reporting of 9-1-1 Services has value. Support solutions and cooperation. Provide incentives for people to communicate and work together for a better Public Safety Solution across the Country. Set deadlines and encourage Carrier Workshops and to achieve a common vision of the future. Set some stakes in the ground.

Respectfully submitted,
/s/

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Part 4 - Narrative on Reliability in 9-1-1 Operations

Operations - Important to the 9-1-1 networks of today and into the future ...

The subject of loss of visibility to the network from carriers Operations Support Systems (OSSs) was raised in the Notice[7]. Physical diversity in the monitoring and control infrastructure is of the utmost importance. OSSs provide surveillance personnel with insight into whether the Network is performing as designed and engineered in near real time or not. Loss of real time information about the health of the network is crucial during an outage. Simple thresholds can assist a small workforce in knowing the network is at risk well before any customer experiences an outage or blockage of calls destined to 9-1-1 call takers and beyond,

9-1-1 related data comes from many sources. When usage and maintenance data is continuously available, they provide operations with a logical view of the network in near real time. For example, should Network Elements (NEs) in either the Carrier and/or Transport Provider architecture(s) fail to function or send data, the status presented to operations personnel is changed by the very absence of such data. Often the first NE task to be discarded in an overload is the production of data. That is done to conserve and to protect call processing according to the standards for the particular NE. The absence of data is a reason to be of concern. All data can be trended and is useful for setting up alerts and scenarios for positive actions.

A reliable operation has many diverse sources along a call path, all reporting activity and exceptions. With this data several things may be done to continue to monitor and control the network even during outage occurs:
1. Create an alert or exception with the absence of data from any expected source.
2. Use 30 second "discretes" in the Network Management Systems, assuming they are used on the larger carrier network architectures, to detect Switches going in and out of severe overload conditions.
3. Use continuous pattern analysis to establish a database and trend history of normal loads and set flags when actual loads are statistically above and below the norm. This indicates potential risk to service quality no matter what the reason.
4. Use commercially available Information Technology (IT) systems that proactively monitor the health of the OSSs monitoring the network.
5. Review OSS infrastructure that is obsolete. Move to either newer technology and/or find new ways to alarm and send messages for critical services such as 9-1-1, SS7 components, fiber, digital cross connect systems power and back-up power plants, and timing sources.

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[7] *See Notice* page 8, "Physical Diversity of Monitor and Control Links"

6. If needed, create a "hotline" type of alarm circuit which bypasses the OSS in question. This can be used to alert first responder organizations that there are problems affecting communications with the public.
7. Focus on real time apps and solutions which provide a greater level of alerting to parties with a "need to know" when there is an event. This will provide a quicker response to any exception affecting 9-1-1 across the network.

Challenges experienced in Next Generation 9-1-1

At Assure911, we are working with regulators, clients, and public safety officials to address issues that have arisen as we endeavor to roll out a standards-based Next Generation 9-1-1 system. While it is beyond the scope of the NPRM Comment period to describe, and then propose solutions with impacts studies for each of the issues we see in our work, Assure911 does feel it is appropriate to describe at a high level some of the major issues that we have come across. We hope these and other comments from the industry will provide the Commission with insight into solutions that will support the national transition to NG9-1-1.

Transition to new technology

In IP-based networks, including Next Generation 9-1-1, the same new underlying infrastructure is employed to both transmit public safety data and monitored operational data and control commands. In addition, significant critical components for the transport and the interfaces at the Points of Interfaces (POIs) are often Routers and Hubs, and Servers mounted in small racks and powered very differently than traditional telco equipment. Those forms of technology are used worldwide and they are prevalent in many countries, replacing outdated circuit switch technology at a rapid pace.

Even in rural America, Regional and Competitive Carriers are rapidly replacing their outdated circuit switches with software-based switching systems and IP-based technology. In the long distance market, a significant portion of the network is carried using these technologies. This is true from the largest to the smallest entities. If the Public Switched Telephone Network (PSTN) as we know it were to become obsolete, then we should be learning from the transition that is underway now, anticipating the need to build in the systems tools and measures to meet any challenges.

Networks are engineered for the normal circumstances. Unfortunately, the abnormal occurs every day, somewhere. Extraordinary dynamic routing is in place in the network, allowing traffic and loads to shift without a lot of human intervention. However, *critical services* must be monitored and assistance provided should events similar to those that happened in June 2012 recur ... and they will.

Regulatory Impact on Engineering and Capacity

Regulatory requirements sometimes form barriers. For example, in the state of Illinois, economics dictate the regulatory rule of thumb: No more than 1 call in 100 can fail for 9-1-1. No less than 2 circuits ought to be provided from any location. As a result, the whole network throughput is guided by the fact that no more than 2 simultaneous voice connections can complete to a Public Safety Answering Point (PSAP) for 9-1-1 from a particular switch if they are served by minimum 9-1-1 trunks.

The total capacity available at any one time from the Carrier network, if it is designed to meet the regulatory requirement and not beyond would be limited to 160 to 180 MBs. Next Generation 9-1-1 solutions allow for the transmission of simultaneous voice, text video and data to the PSAP. Testing has validated that these transmissions may consume up to 450 MB of bandwidth. Clearly, that will not fit on 2 trunks in today's legacy network architecture. Next Generation 9-1-1 networks will under-serve the public demand in high volume demand situations, if the regulatory engineering guidelines for capacity on the access side do not rise to match the requirements and capabilities of the new end to end solutions.

The Commission and NTIA have been encouraging, through Grants and NPRMs, Broadband deployment across America, especially to Rural America. The result is, as may be expected, that there is a significant amount of bandwidth available even in the most rural areas. Not all of it is in ring configuration, but Ethernet over Fiber or Ethernet over Copper is available. Even in rural southern Illinois, for example, it is possible to find four (4) or five (5) carriers that could complete calls if the Cost Recovery and decision making power were in place. There is available diversity now from BTOP Grant awardees: Ethernet over Fiber, at reasonable prices as a viable alternative transport facility. The issue now: will the Commission, state and local counterparts encourage and/or require embedded Access Carriers connect diversely using those facilities for 9-1-1. The Carriers should embrace diversity even when using components of other carriers. These other carriers are most often already co-located in the telco buildings of the major carriers. A simple connection between carriers can result in getting diverse 9-1-1 turned up in a matter of hours, avoiding an expensive and unnecessary build out to the new Data Centers, which will take anywhere from 30 to 90 days once contracts are signed.

Network Security and Protection

We know more demand does not always mean more "trauma", but when it does, on the "not so sunny day", there is reason to believe the network architecture for 9-1-1 can hold its own. One of the largest financial investments required in the Next

Generation 9-1-1 network infrastructure is the Session Border Controller (SBC). New NG9-1-1 Data Centers, deployed in geographically diverse locations, sharing the load and backing each other up, will have an SBC in each location where calls arrive both legacy and IP, circuit switched and soft switched, using SS7, MF/CAMA, ISDN-PRI or newer SIP protocols.

These SBCs can take the load and throttle it, alert when necessary, move traffic correctly and rapidly to the designated NG9-1-1 Functional Element (FEs) for routing the calls. Carriers can let much more 911 of the traffic go to the NG9-1-1 system, but that is not yet the mindset of all Access Carriers. Some Carriers argue for fewer circuits, saying, for example, that they will take the two (2) 9-1-1 trunks from their switch and connect one to the Primary NG9-1-1 Data Center, and the other to the Alternate backup Data Center.   That may be diverse, and, in fact in the Alternate PSAP Diversity category we show in the Diversity Reporting Table 2 above. The goal can and should be Primary PSAP Diversity using as many trunks as can be provided over the Transport facility and are available in the originating end office.   Yes, it theoretically "costs more" because it doubles the trunking. Considering the large loss of lines in the PSTN, with migration to Wireless, we expect that in today's switches there is available trunking capacity available to be deployed, remaining so until the switches are to be retired.

In fact, we expect there to be the capacity available to add at least a full T1, to reference old technology, to each of the Dual Data Centers, from each end office, thus allowing much more 9-1-1 traffic to be routed directly to the NG9-1-1 ESInet, and not arbitrarily throttled back at the "Selective Router", as is done today. With the SBC protecting the NG9-1-1 FEs, typically interfacing at a T1 and above level, a full T1 of 9-1-1 circuits from each end office would not overload the NG9-1-1 FEs. Furthermore, this sets up the SBCs to be able to monitor and discard attempts related to DDoS and TDoS attacks and send through only the steady stream of good calls. Calls about the same incident can be queued inside the NG9-1-1 FEs. So even in the case of a road accident generating 100 calls, at the same time a single call from a neighbor having a heart attack, the calls can get through and be processed. We recommend using as many trunks as the dormant physical capacity in network will allow for 9-1-1. Reason says if there is existing physical capacity to bring in a T1 circuit, and that the NG9-1-1 system can handle the load, then all *logical* trunks on that T1 should be employed. Why not use up to 24 channels of capacity in each path. In our work to date, we argue for any number of trunks *more than 1*. Our goal in these discussions is to use Primary PSAP(s), Alternate PSAP(s), and Disaster Recovery Diversity PSAP(s), so that a single or even duplex trunk failure will not take out the 9-1-1 access network customers abilities to reach assistance.

The signaling from the access network must also be discussed. CAMA/MF infrastructure is the current method for routing calls from the Legacy Selective Routers (SRs) to existing E9-1-1 PSAPs. While these trunks are old by any standard, call set up times are generally within expected limits. However, extending the call path from the older Selective Routers through a Legacy Network Gateway (LNG)

into the NG91-1- system could introduce delays that render the call set up time unacceptable. Many seconds of time could be saved by using SIP, SS7, or ISDN-PRI signaling from the source central office. In places where SIP, SS7, or ISDN-PRI signaling cannot go all the way through, then convert to SIP as soon as practical. Many times Carriers have added SIP trunking capabilities to their Legacy end office network for use by Enterprise Customers with IP PBXs. If the SIP trunking is in the Central Office, we recommend using it for 9-1-1, the most valued of Customers.   We recommend getting the CAMA/MF circuits completely out of the 9-1-1 architecture ASAP.

Physical Diversity

We would recommend deployment of physical diversity where possible for Host/Remote network access connectivity. In some configurations, the umbilical from Host to Remote can ride a fiber ring rather than a single threaded star configuration T1; the chances of a single Remote (often a whole town) being isolated from 9-1-1 is reduced.   However, in many rural areas actual physical diversity is a challenge, and often whole towns are served via an umbilical link from a Remote Switch to a Host Switch, riding a one and only available facility. If the umbilical facility fails, the town is isolated from all landline services.   This is indeed a challenge; however, more than 80% of 9-1-1 calls today are wireless calls. Wireless carriers can and should be given direct trunking access to the Data Centers, which means not riding behind the Legacy Selective Routers, thus reducing the need to install diversity from each Remote in the landline-isolated town. Wireless carriers could reach the NG 9-1-1 network from the Wireless Switch locations. We believe that it would be possible to achieve such MTSO-to-NG9-1-1 Data Center diversity. There is not much more to say except all things depend on economics and cost recovery. How to technically achieve diversity is known. The decision is a matter or priority and/or financial incentive.

In some jurisdictions, local or state regulations will need to be revisited.   For example, the Illinois Commerce Commission, (ICC), still requires Call Boxes in the wireline network.   In the case of an end office becoming isolated, a call box is manned by the Police to take the 9-1-1 calls. This means time and radio traffic for assistance, i.e., valuable resources of the Police Departments are manning Call Boxes, and are not dispatched to save lives. Also Caller ID, address information, and database do not function from a Call Box. Call Boxes are not installed at the Wireless Switch locations. The 9-1-1 call demand be very low from the Landline locations where call boxes are required, a single manned remote or host end office, may not produce very many calls for 9-1-1. The concept was great for the era when most traffic came from the PSTN. We need to move to a more reliable platform. Incentives need to be there to get away from totally obsolete solutions and into better ways to manage: Satellite, microwave, temporary use of COWs, Cellular on Wheels. Even older technology can span distances and provide diversity if the conditions demand.

The regulatory requirement should be to have a plan in place and the capabilities tested and ready to deploy is more important than to dictate specific solutions that are outdated and have little value.

Local Number Portability (LNP)

Certain legacy services may also need to be revisited, for example, Local Number Portability (LNP). LNP introduces interesting failure scenarios for 9-1-1. LNP means customers who are next door to each other maybe served by technology that originates their calls (dial tone) sometimes in another state, sometimes in a far different county and the Competitive Carrier routes them back locally to their agencies for Public Safety. The disruption of any traffic for physical or logical reasons can mean one neighbor has 9-1-1 access and the other does not for no apparent reason. Trouble shooting and database of this information ought to be a critical consideration for 9-1-1 solutions. We acknowledge LNP is a good solution for CLECS and for cost reduction to customers. If the LNP information is databased in a way to allow for testing and resolving problems rapidly, then certainly LNP is no better or worse that what a customer has today for 9-1-1. The key is knowing it and being able to trouble shoot rapidly and resolve network problems.

Signaling System Seven (SS7)

The way legacy services are priced is another point to mention. For example, the cost model for SS7 circuits is geared to carrier flat rate volumes. While SS7 serves as access signaling for 9-1-1, for many carriers, the carrier flat rate model makes SS7 unrealistic from a cost perspective, for a Regional or Local 9-1-1 agency, and certainly beyond the reach of an individual 9-1-1 agency. If there were a national clearinghouse for 9-1-1 on SS7 to ensure diverse and reasonable rates, it would help everyone who wants to migrate and use SS7 as their interim signaling option to enter the Legacy Network Gateways (LNGs). It does not appear at this time that any standards bodies or influencing organizations are working on this issue. It is a roadblock to success in carrier negotiations and contracts. An SS7 provider that can agree to serve 9-1-1 diversely at a reasonable cost can break the bottleneck. We stated earlier that SIP signaling is a preference, but the reality is that SS7 as the signaling for traffic from access carriers will have to be supported in NG9-1-1 systems a while longer. The volume of SS7 traffic generated by 9-1-1 calls, should not (on a normal day), add significant load to any carrier's SS7 network; the costs to the SS7 provider are establishing the links and monitoring the network. The access carriers, who have existing SS7 "A" links, would see no effect- SS7 to the NG9-1-1 System would function in the same way as it does to the Selective Router. While the use of SS7 "F" Links, links which directly connect between the end office and the NG9-1-1 Data Centers, could eliminate the need for an SS7 STP pair provider, it is an unrealistic choice. "F" links would be required in each end office, a prohibitive

burden. CLLI and LERG updates would be required to get connected. "F" links are not used to a large degree in the Carrier network. "F" Links are also not easy to monitor since much of the link monitoring by Network Operations Centers (NOCs), comes from the STPs. The SS7 links are critical today. Everywhere SS7 is deployed to the Data Centers, the MF/CAMA trunks could be eliminated from the network architecture.   Refer to any outage reports where MF/CAMA was a part of the problem.

The Local Exchange Routing Guide

There are two issues with the LERG as it relates to Next Generation 9-1-1. First, VoIP providers are not in the LERG. IP addresses, where the underlying equipment is located, and how it is connected to the public broadband network are not described in any publicly accessible database that we could locate. This makes it challenging for a 9-1-1 SSP to fully understand the physical path that the VoIP calls take to come into the NG9-1-1 ESInet. The second issue is cost; each 9-1-1 SSP will need access to the LERG and the cost is relatively high. If Telcordia Technologies (now Ericsson), perhaps in association with NENA, could provide cost effective, ongoing access to the LERG, then the cost of mapping the 9-1-1 infrastructure for planning diagrams could be reduced. It will also facilitate maintaining the network diagrams in the event of the network re-home, new codes, and other changes in the routing to the NG9-1-1 system.

Common Language Location Codes

Not all CLECs are required to assign CLLI to their network nodes. This means there are sources of data unavailable, and local negotiations have to be pristine.

High Quality Reference Data

To achieve high end-to-end Service Quality on 9-1-1, all information pertaining to 9-1-1 needs to be available in some logical, accessible fashion at a reasonable cost. That information ought to allow easy discovery of diverse Carriers in the network. In our experience, if records are clean, kept up-to-date, and in trustworthy condition, hours of work are saved during outages. Searches and sorts could be developed to keep it in sync with the data coming from the network in real-time, as well as changes to databases in the routing tables, ECRFs, LoST servers, and other places where network information is stored.   The change control process in an NG9-1-1 arena is most likely being worked by a NENA committee. Access issues are the hold up for deployment of NG9-1-1 networks today. Cooperation and speedy and timely responses to inquiries are keys to success, and of course reasonable pricing.

The Bottom Line

Build out and clean up Infrastructure, Diversify, use OSS and NEs information, and share near real time data end-to-end; build partnerships for success. Enhance Best Practices to meet the transitional challenges of NG9-1-1. Build interfaces to the Commission's NORS and DIRS systems, as well state reporting systems. Set up the system internally so false reports cannot be made and ease the burden on the people trying to simultaneously fix problems, make reports, and keep them updated. Make it reasonable to have Situational Awareness at the Federal Communications Commission and/or State Commission level so the agencies can see the patterns and exceptions, and know true service impacts of a disaster or focused overload large or small. It is technically possible and without a high cost. Build in Operations capabilities at the same time you build the Network. Managing 9-1-1 cannot be an after-thought.